REMARKS

Claims 1-8 are all the claims pending in the Application.

Applicants thank the Examiner for acknowledging the claim for foreign priority and the receipt of the priority document.

Applicants thank the Examiner for reviewing and considering the references cited in the Information Disclosure Statements filed on January 10, 2002 and February 7, 2002, respectively.

Claim Rejections - 35 U.S.C. § 112

Claims 7 and 8 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter. This rejection is traversed.

Applicant submits that a person of ordinary skill in the art would have easily understood claims 7 and 8 as filed. However, in the interest of furthering prosecution of the Application, Applicant amends claims 7 and 8. Claims 7 and 8 are now believed to be in form for allowance.

Claim Rejections - 35 U.S.C. § 102

Claim 1 and 6 are rejected under 35 U.S.C. § 102(b) as being anticipated by Miyakawa, et al. (U.S. Patent No. 4,970,632). This rejection is traversed.

Claim 1 requires, *inter alia*, that a sum total of a thickness of a substrate and a polarizing plate is set in accordance with a definition of the display image.

Miyakawa discloses a liquid crystal device having microlenses in correspondence with pixel electrodes. Miyakawa discloses that the liquid crystal 11 is filled in a space between orientation diaphragms 12A and B, which are at a predetermined distance. (Miyakawa, col. 1, lines 30-34.) Miyakawa also discloses microlenses on at least one of the base plates 15A and B in correspondence with the pixel electrodes for converging light rays. (Miyakawa, col. 2, lines 18-24.) Miyakawa does not disclose or suggest a sum total of a thickness of a substrate and a polarizing plate. Clearly, Miyakawa does not disclose or suggest a sum total of a thickness of a substrate and a polarizing plate set in accordance with a definition of the display image, *as inter alia* required by claim 1.

The Examiner cites Miyakawa Fig. 2 and implies that Fig. 2 discloses these features. In fact, Fig. 2 does not disclose or suggest any particular thickness of a substrate or of a polarizing plate, let alone a sum total of a thickness of a substrate and a polarizing plate. Therefore, Miyakawa does not even remotely disclose or suggest all the recitations of claim 1.

Claim 6 depends from claim 1 and therefore incorporates all the recitations thereof. Accordingly, claim 6 is patentably distinguishable over the prior art for at least the reasons that claim 1 is patentably distinguishable over the prior art.

Claim Rejections - 35 U.S.C. § 102

Claims 1-3 are rejected under 35 U.S.C. § 102(a), as being anticipated by Yamaguchi (JP 2001-188230A). This rejection is traversed.

The Yamaguchi Japanese document publication relied on by the Examiner, Japanese Patent Publication No. 2001-188230, was published on July 10, 2001, <u>after</u> the filing of the present Application's Japanese priority document, Japanese Patent Application No. 2000-308889, filed in Japan on October 10, 2000. A certified English-language translation of the Japanese priority document, Japanese Patent Application No. 2000-308889, is attached herewith. Applicant hereby perfects priority. The Examiner is requested to remove the Yamaguchi reference and to withdraw the rejection.

(The Yamaguchi Patent (U.S. 6,421,103) filed in the United States has a filing date of December 28, 2000. This date is also <u>after</u> the Japanese priority date of October 10, 2000 of the present Application.)

Claim Rejections - 35 U.S.C. § 103

Claims 1, 4, 7 and 8 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Funada, et al. (U.S. Patent No. 4,486,760) in view of Kida, et al. (U.S. Patent No. 5,321,789). This rejection is traversed.

Applicant notes that in the penultimate line of page 4, the Examiner lists claim 5 as well as the other claims as rejected. However, claim 5 is not listed as rejected under this rejection in the first paragraph of the rejection. Applicant's representative telephoned the Examiner to get clarification about the status of claim 5. On March 5, 2003, the Examiner stated that claim 5 is rejected under this rejection.

Funada discloses a liquid crystal display/record cell. Funada discloses a glass substrate made of soda glass of 1mm thickness. Funada does not disclose or suggest a sum total of a thickness of a substrate and a polarizing plate. Clearly, Miyakawa does not disclose or suggest a sum total of a thickness of a substrate and a polarizing plate set in accordance with a definition of the display image, *as inter alia* required by claim 1. The Examiner cites no portion of Funada that discloses these features.

Kida discloses a projection display apparatus and light guide tube/light valve for use in the same. Kida does not remedy the deficiencies of Funada as they relate to Applicant's invention.

Claim 4, 5, 7 and 8 depend from claim 1 and therefore incorporate all the recitations thereof. Accordingly, claims 4, 5, 7 and 8 are patentably distinguishable over the prior art for at least the reasons that claim 1 is patentably distinguishable over the prior art.

In view of the foregoing remarks, reconsideration and allowance of this Application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned attorney at the telephone number listed below.

A Petition for Extension of Time for a one (1) month extension, with fee, is submitted herewith.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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WASHINGTON OFFICE
23373
PATENT TRADEMARK OFFICE

Date: June 5, 2003

APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is amended as follows:

Page 35, first full paragraph:

First, as the porous plate 2, a porous plate was prepared in which circular through-holes 21 having a diameter of 5 mm were provided at a ~~closest~~ pitch of 0.1m (in terms of partition thickness; see Fig. 6A) in a closest packet structure. The thickness of the porous plate 2 was 15 mm. The distance (spacer thickness) from the outlet side (upper surface) of the porous slate 2 to the LCD 3 was 2mm. The above-mentioned "instax mini" film pack was used as the photosensitive film 4.

Page 36, first full paragraph:

As the porous plate 2, there was prepared one in which circular through-holes 21 having a diameter of 5mm were arranged in a ~~closest~~ pitch of 0.1 mm in a closest packed structure. Two levels were adopted for the thickness of the porous plate 2 and the distance from the outlet side (upper surface) of the porous plate to the LCD 3. For the first level, the thickness of the porous plate 2 was changed to 10 mm, and the distance from the outlet side (upper surface) of the porous plate to the LCD 3 was changed to 5mm. For the second level, the same values as in Examples 2-1 to 2-9, to be more specific, 15 mm for the former and 2mm for the latter were used.

Page 43, first full paragraph:

Specifically, a reduction in the dimension of the through-holes or an increase in the thickness of the porous plate is effective. To achieve a reduction in the thickness of the entire apparatus, however, the former is more desirable. Due to the limitations in production, the ~~upper~~ lower limit of the through-hole dimension is approximately 0.2 mm. From the practical point of view, values of approximately 0.5 mm. to 2 mm are preferable. Regarding the thickness, values of approximately 3 mm to 20 mm are preferable from the practical point of view. While in the above example the value of the "thickness of porous plate/through-hole dimension of porous plate" is 3, this value is preferably not less than 5, and more preferably not less than 7.

IN THE CLAIMS:

The claims are amended as follows:

1. (Amended) A transfer apparatus comprising:

a light source;

a transmission-type image display device in which a liquid crystal layer is held between two sets of substrates and polarizing plates; and

a photosensitive recording medium,~~;~~

wherein the light source, the transmission-type image display device and the photosensitive recording medium are arranged in series along a direction in which light from the

light source advances, and a display image transmitted from the transmission-type image display device is transferred to the photosensitive recording medium, and

wherein the transmission-type image display device and the photosensitive recording medium are arranged in a non-contact state, and a distance between the transmission-type image display device and the photosensitive recording medium and a sum total of a thicknesses of a substrate and a polarizing plate at least on a side of the photosensitive recording medium in the transmission-type image display device are set in accordance with a definition of the display image.

7. (Amended) The transfer apparatus according to Claim 6~~1~~, wherein said substantially parallel rays generating element comprises a porous plate having a plurality of through-holes, ~~and~~ wherein the porous plate has a thickness not less than three times the diameter or equivalent diameter of said plurality of through-holes~~.~~, and wherein parallel rays are obtained by passing said light from said light source through said plurality of through-holes of said substantially parallel rays generating element.

8. (Amended) The transfer apparatus according to Claim 7~~1~~, wherein said plurality of through-holes are parallel to each other and have a circular or polygonal cross section.

CERTIFICATE OF TRANSLATION

I, Teiichiro OGAWA, am on a staff of ION PATENT of Hayakawa-Tonakai Bldg. 3F, 12-5, Iwamoto-cho 2-chome, Chiyoda-ku, Tokyo, Japan, do solemnly and sincerely declare that I am conversant with the Japanese and English languages and I have executed with the best of my ability this translation into English of Japanese Patent Application No. 2000-308889 attached hereto which was filed on October 10, 2000 in the name of Naoyoshi CHINO et al. / FUJI PHOTO FILM CO., LTD. and believe that the translation is true and correct.

Tokyo: June 2, 2003

T. Ogawa

Teiichiro OGAWA

JAPAN PATENT OFFICE

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: October 10, 2000

Application Number: Japanese Patent Application
No. 2000-308889

Applicant: Fuji Photo Film Co., Ltd.

September 10, 2001

Commissioner,
Japan Patent Office
Kozo OIKAWA

Certificate No. 2001-3083128

Japanese Patent Application No. 2000-308889

[TYPE OF THE DOCUMENT] APPLICATION FOR PATENT

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[FILING DATE] October 10, 2000

[DESTINATION] Commissioner of the Patent Office

[INTERNATIONAL PATENT CLASSIFICATION] G03B 27/32

[TITLE OF THE INVENTION] TRANSFER APPARATUS

[NO. OF CLAIMS] 5

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[INDICATION OF CHARGE]

[DEPOSIT RECORD NO.]	006910
[AMOUNT OF PAYMENT]	21000

[LIST OF ATTACHED DOCUMENT]

[TYPE OF DOCUMENT]	Specification	1 set
[TYPE OF DOCUMENT]	Drawing	1 set
[TYPE OF DOCUMENT]	Abstract	1 set

[GENERAL POWER OF ATTORNEY NO.] 9800463

[REQUEST FOR PROOF] YES

Japanese Patent Application No. 2000-308889

[TYPE OF THE DOCUMENT] Specification

[TITLE OF THE INVENTION] TRANSFER APPARATUS

[CLAIMS]

[Claim 1]

A transfer apparatus comprising a light source and a transmission type image display device to transfer a displayed image on said transmission type image display device to a photosensitive film,

wherein a sum total of thicknesses of a substrate and a polarizing film at least on a side of said photosensitive film in said transmission type image display device is 1.0 mm or less.

[Claim 2]

The transfer apparatus according to Claim 1, wherein the image displayed on said transmission type image display device and the image transferred to said photosensitive film are substantially identical in size.

[Claim 3]

The transfer apparatus according to Claim 1 or 2, wherein each pixel size of said transmission type image display device is 0.2 mm or less.

[Claim 4]

The transfer apparatus according to any one of Claims 1 to 3, in which, in addition to said construction, a

substantially parallel rays generating element formed of a porous plate having through-holes of a circular or polygonal cross section is arranged between said light source and said transmission type image display device,

wherein the porous plate constituting the substantially parallel rays generating element has a thickness not less than three times the diameter or equivalent diameter of said through-holes.

[Claim 5]

The transfer apparatus according to any one of Claims 1 to 4, wherein said transmission type image display device is a liquid crystal display.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[Technical Field of the Invention]

The present invention relates to a transfer apparatus which transfers (forms) an image recorded in digital form by a still camera, a video camera, a personal computer or the like to a recording medium such as an instant photographic film which develops color by light.

[0002]

[Prior Art]

Conventionally known examples of a method for transferring (or printing) a digitally-recorded image to or

on a recording medium include an ink jet system using a dot-type printing head, a laser-driven system, and a thermal recording system. The transfer apparatuses of these systems have a problem that they involve complicated driving and control mechanisms, resulting in large sizes and high costs.

[0003]

In this regard, a transfer apparatus which forms an image on a recording medium such as an instant film may be suggested. Conventionally, "Photosensitive Recording Apparatus" disclosed in JP 8-271995 A, for example, is known as a transfer apparatus of this type. The transfer apparatus is characterized in that it uses a gradient index lens array in order to simplify the optical system as well as to reduce the cost of the apparatus.

[0004]

That is, the apparatus is characterized in comprising a light-emitting element having a large number of light-emitting dots, a gradient index lens array arranged in vicinity of said light-emitting element such that the central axis of the array crosses with an irradiating direction of said light-emitting element, a first optical device (e.g., a mirror) for having the light from said light-emitting element incident on said gradient index lens

array, and a second optical device (e.g., a mirror) for having the light that has passed through said gradient index lens array reach a photosensitive recording medium.

[0005]

More particularly, an apparatus like the one shown in Fig. 5 is suggested. That is, a color film photosensitive recording apparatus 50 shown in the drawing comprises mirrors 55, 56 arranged on the light incident side 53a and the light ejecting side 53b, respectively, of said gradient index lens array 53, and said color film photosensitive recording apparatus 50 is structured such that the apparatus is movable in a direction parallel to a fluorescent tube 54 and a photosensitive surface of a color instant film 58 as a photosensitive recording medium. An RGB color filter 57 is interposed between the fluorescent tube 54 and the mirror 55.

[0006]

The color film photosensitive recording apparatus 50 constructed as mentioned above drives the fluorescent tube 54 to cause each light-emitting dot to illuminate at a predetermined timing and exposes the color instant film 58 by a so-called scanning exposure, moving the whole color film photosensitive recording apparatus 50 in parallel to a photosensitive surface of the color instant film 58 at a

constant speed at the synchronized timing with the illuminating drive.

[0007]

During the above-mentioned illuminating drive of the fluorescent tube 54, the RGB color filter 57 is switched over to scan the color instant film 58 three times in total, so that the illumination of the fluorescent tube 54 is decomposed into respective RGB colors to perform the photosensitive recording (image formation, hereinafter referred to as image exposure) onto the color instant film 58.

[0008]

In the color film photosensitive recording apparatus 50, it is said that since the gradient index lens array 53 is arranged perpendicularly to the light irradiating direction of the fluorescent tube 54, the whole construction can be significantly thinner than the conventional apparatus of this type, realizing the more compact and portable color film photosensitive recording apparatus.

[0009]

Since the above-mentioned color film photosensitive recording apparatus 50 performs the image exposure with decomposition of three colors of RGB through a lens system

even though the apparatus utilizes the gradient index lens array 53, however, there is a problem that the whole apparatus has a limit in compactifying and the exposure process takes a long time.

[0010]

[Problems to be Solved by the Invention]

"Transfer Apparatus" disclosed in JP 11-242298 A can be referred in this regard. The transfer apparatus can achieve, as compared with the aforementioned transfer apparatus (the color film photosensitive recording apparatus), a further reduction in terms of size, weight, power consumption, and cost. A photosensitive film is closely attached to the display surface of a transmission type liquid crystal display, and a light source provided on the opposite side of said photosensitive film with respect to said liquid crystal display is turned on, whereby the image displayed on the liquid crystal display is transferred to the photosensitive film.

[0011]

More particularly, in the transfer apparatus, a lattice is provided between the above-mentioned light source and the liquid crystal display, whereby diffusion of light from the above-mentioned light source is restrained, so that it improves the clarity of the image formed on the

photosensitive film to a satisfactory degree from the practical point of view without providing an optical component or securing an appropriate focal length.

[0012]

The above-mentioned point is described below in more details.

For the transfer apparatus described above, an example is shown in which the thickness of the liquid crystal display (hereinafter referred to as LCD) is 2.8 mm and the image on the screen of the LCD with a dot size of 0.5 mm is transferred to the film. To prevent diffusion of the light from the LCD, there is provided a 5 mm lattice with a thickness of 10 mm, and a 20 mm spacer is arranged between the lattice and the LCD. Further, the LCD and the photosensitive film are closely attached together to transfer the image.

[0013]

In this example with the construction as mentioned above, an image displayed with an original dot size of 0.5 mm is transferred with an enlarge dot size of up to 0.67 mm, which means an enlargement by approximately 0.09 mm on one side, and yet the image obtained is satisfactory from the practical point of view.

[0014]

Recently, the screens of LCDs have progressed in terms of definition, and LCDs with an increased number of pixels and a smaller dot size are being commercialized. For example, LCDs using low-temperature polysilicon type TFTs of UXGA (10.4 inches; 1200 x 1600 pixels), XGA (6.3 and 4 inches; 1024 x 768 pixels) and the like are on the market.

[0015]

In the former case, the dot size of each of the RGB pixels is approximately 0.04 mm on the shorter side. In the case like a transfer apparatus as previously described (in the above-mentioned example of the transfer apparatus) in which enlargement in dot size is involved, it would be impossible to transfer an LCD image of such a minute dot size to a photosensitive film with satisfactory clarity in a condition in which the dots of the RGB pixels are clearly distinguishable.

[0016]

In addition, there is a significant problem with transferring an image by having the LCD and the photosensitive film closely attached together as in the example previously mentioned. That is, on the outermost surface of the LCD, there is normally arranged a polarizing film and therefore the photosensitive film is closely

attached to the polarizing film. Being closely attached during exposure and when the photosensitive film is moved to perform a post-processing, the photosensitive film and the polarizing plate are rubbed against each other to thereby flaw the polarizing film, and the flaw on the polarizing film is transferred to the photosensitive film. Further, this flaw causes scattering of light, resulting in deterioration in the image quality.

[0017]

To this problem, it might be possible for the photosensitive film and the polarizing film to be closely attached together during exposure and slightly spaced apart from each other when the photosensitive film is moved. For this purpose, however, it would be necessary to provide an additional mechanism, which is contradictory to the requirement for a reduction in cost and size.

[0018]

In the case an instant film which is the easiest to use is used, such film is kept in a lightproof case until it is loaded in a transfer apparatus. Since this lightproof case is equipped with an opening frame somewhat larger than the film, the following procedures must be followed before the photosensitive film can be brought into close contact with the polarizing film.

[0019]

First, prior to exposure, one photosensitive film is extracted singly from the above-mentioned lightproof case, and brought into close contact with the surface of the polarizing film on the surface of the LCD. In this condition, exposure is performed, and, after the completion of the exposure, the photosensitive film is separated from the polarizing film surface, and moved for a next processing (in the case of an instant film, a processing liquid tube provided in the film sheet is pushed open).

[0020]

The above procedures must be repeated for each photosensitive film. In particular, separating the photosensitive film from the polarizing film surface does not square with automation (or mechanization).

As described above, "Transfer Apparatus" disclosed in JP 11-242298 A involves many problems in practical point of view.

[0021]

The present invention has been made in view of the problems described above, and it is an object of the present invention to eliminate the above problems in the prior art and to provide a transfer apparatus which can realize a substantial reduction in size, weight, power

consumption, and cost with a simple structure.

[0022]

[Means to Solve the Problems]

In order to attain the object described above, a transfer apparatus according to the present invention comprises a light source and a transmission type image display device (e.g., the aforementioned transmission type LCD) to transfer a displayed image on the aforementioned transmission type image display device to a photosensitive film, wherein a sum total of thicknesses of a substrate and a polarizing film at least on a side of the photosensitive film in the transmission type image display device is 1.0 mm or less, preferably 0.8 mm or less, and more preferably 0.6 mm or less.

[0023]

The operation of the above-mentioned construction will be described below in detail.

In the present specification, a transmission type image display device includes various types of electronic image display devices represented by said LCD and, in addition to them, further includes transmission type image bearing devices such as a photographic film on which an image is formed.

[0024]

Japanese Patent Application No. 2000-308889

In an example of "Transfer Apparatus" disclosed in said JP 11-242298 A, an LCD with a thickness of approximately 2.8 mm is used. The LCD comprises two polarizing films, two substrates (glass or resin films), and liquid crystal held between them. The thickness of liquid crystal itself is approximately 0.005 mm (Color TFT Liquid Crystal Display: p 207, published by Kyoritsu Shuppan). Thus, it is to be assumed that the sum total of the thicknesses of the substrate and the polarizing film on one side is approximately 1.3 mm to 1.4 mm.

[0025]

Light diffusion degree is in proportion to distance. Thus, when the above-mentioned thickness of 1.3 mm to 1.4 mm is reduced by half, the diffusion degree is also reduced by half, and it is to be assumed that the above-mentioned value "enlarged by approximately 0.09 mm on one side" is also reduced to 1/2, that is, approximately 0.04 mm to 0.05 mm. However, with this level of diffusion degree, overlapping of adjacent dots occurs in an LCD with a minute dot size, such as the above-mentioned latest UXGA or XGA.

[0026]

That is, when the diffusion degree is solely reduced to approximately 0.04 mm to 0.05 mm, the image obtained is rather unclear due to the occurrence of dot overlapping and

color blurring attributable thereto. However, quite unexpectedly, a study by the present inventors has shown that, as stated above, by setting the sum total of the thicknesses of the above-mentioned substrate and the polarizing film on one side at 1.0 mm or less, the color blurring due to dot overlapping is eliminated even in the case of an LCD of a minute dot size, such as UXGA or XGA, making it possible to obtain a clear transfer image. (It is to be assumed that this is due to the fact that the scattering by the glass and the polarizing film of the LCD is reduced.)

[0027]

That is, a study by the present inventors has shown that in the case of a transmission type LCD, it is desirable for the sum total of the thicknesses of the above-described substrate and polarizing film is set at 1.0 mm or less, preferably at 0.8 mm or less, and more preferably at 0.6 mm less. To realize the above condition, since it is assumed the thickness of the glass substrate can only be reduced to approximately 0.5 mm, the construction does not necessarily use glass substrates and it is also effective to consider using resin substrates.

[0028]

The essential features (construction) and operations

of the present invention are as mentioned above. Described below are the various conditions that are effective if employed in combination therewith.

[0029]

In the transfer apparatus of the present invention, it is desirable that the size of the image displayed on the aforementioned transmission type image display device (LCD) be substantially the same as the size of the image transferred to the aforementioned photosensitive film. That is, a direct transfer system is adopted in which no enlargement or reduction is effected using a lens system, thereby it is possible to realize a reduction in the size and weight of the apparatus.

[0030]

It is desirable for the size of each pixel of the aforementioned transmission type image display device (LCD) used in the transfer apparatus of the present invention to be 0.2 mm or less. This condition, of course, leads to obtaining a clearer transfer image.

[0031]

In the transfer apparatus of the present invention, in addition to the construction mentioned above, it is desirable for the sum total of the thicknesses of the substrate and polarizing film on the opposite side of the

aforementioned photosensitive film of the aforementioned transmission type image display device (LCD) to be also 1.0 mm or less, preferably 0.8 mm or less, and more preferably 0.6 mm or less. Such construction is equivalent to suppression of light diffusion from the light source to the LCD, realizing a clearer transfer image to be obtained.

[0032]

Further, in the transfer apparatus of the present invention, it is preferable that the display surface of the aforementioned transmission type image display device (LCD) and the photosensitive surface of the aforementioned photosensitive film are apart from each other by a predetermined distance (e.g., by approximately 0.01 mm to 3 mm, preferably 0.1 mm to 2 mm, and more preferably 0.2 mm to 1 mm.) This arrangement is rather disadvantageous from the viewpoint of obtaining a clear transfer image. However, it is a condition necessary for realizing an apparatus actually easy to handle as described later, and the disadvantage due to this arrangement can be compensated for by other advantages.

[0033]

Further, in addition to the aforementioned construction in the transfer apparatus of the present invention, it is preferable that a substantially parallel

rays generating element for converting the light from the aforementioned light source into parallel rays is arranged between the light source and the transmission type image display device (LCD). Its purpose is to make the light incident on the LCD as parallel as possible, and the substantially parallel rays generating element is a device to achieve this purpose.

[0034]

In the transfer apparatus of the present invention, the substantially parallel rays generating element is preferably a porous plate, in view of easiness in manufacture. Further, also for easiness in manufacture, it is preferable that through-holes in the porous plate have a circular or polygonal cross section, but it is not limited to either one of them. The aforementioned porous plate may be produced by, for example, stacking porous sheets together, resin molding or the like, in practical point of view. However, there are no particular limitations in this regard.

[0035]

Further, it is desirable for the diameter (in the case of circular holes) or the equivalent diameter (in the case of polygonal holes) of the through-holes of the porous plate that constitutes the above-mentioned substantially

parallel rays generating element to be 5 mm or less, and it is desirable for the thickness of the porous plate to be not less than three times the aforementioned diameter or equivalent diameter of the through-holes. It goes without saying that these settings are effective conditions to obtain parallel rays by means of the porous plate. Here, the above-mentioned equivalent diameter is a dimension expressed as "4 x area/total-peripheral-length".

[0036]

Further, in the transfer apparatus of the present invention, the distance between the aforementioned substantially parallel rays generating element and the aforementioned transmission type image display device (LCD) is set at preferably 0.05 to 10 mm, and more preferably, 0.1 mm to 5 mm. This measure is taken for the purpose of preventing the pattern of the through-holes in the substantially parallel rays generating element from appearing in the form of a "shadow" due to the diffused light. The above setting of the distance is made such that the appearance of the "shadow" as mentioned above can be prevented, without deteriorating the clarity of the transferred image.

[0037]

[Embodiment of the Invention]

An embodiment of the present invention will now be described below in detail with reference to the accompanying drawings. In the embodiment described below, the aforementioned transmission type LCD is exemplified as a transmission type image display device.

[0038]

Fig. 1 is a schematic side sectional view of an image transfer apparatus according to an embodiment of the present invention. The image transfer apparatus according to the embodiment comprises a light source (back light unit for an LCD, including a cold-cathode tube) 1, a porous plate 2 for generating substantially parallel rays, an LCD 3 connected to a digital image data supply portion such as a digital camera, and a photosensitive film (in this embodiment, a so-called instant photographic film is used) 4.

[0039]

The back light unit for LCD 1 including a cold-cathode tube that serves as a light source is substantially the same as the one that has been conventionally used, and is a planar light source using a diffusion film, prism sheet or the like to evenly diffuse the light emitted by the cold-cathode tube. The size of the light emitting surface may be the same as the size of the photosensitive

surface of an instant photographic film (hereinafter, simply referred to as a film) to be described later. However, this should not be construed restrictively.

[0040]

The porous plate 2 serving as a substantially parallel rays generating element in this embodiment is formed of an aluminum plate with a predetermined thickness, provide with a large number of cylindrical holes 21 of a predetermined size. As described later, the porous plates of various thicknesses were prepared and were used in Examples and Comparative Examples. Further, the whole porous plate 2, including the inner surfaces of the cylindrical holes 21, is black plated to prevent the light reflection. The reflectance rate is measured at a wavelength of 550 nm, using the MPC 3100 spectroreflectometer manufactured by Shimadzu Corporation, and it is preferable that the reflectance rate is not more than 2 %.

[0041]

Various types of LCDs having different sizes of each of RGB color dots (pixels) were prepared for the LCD 3. The LCD's structure itself is the same as the one that has been conventionally used. A digital camera is connected to the LCD 3, so that an arbitrary image can be selected from

among images prepared beforehand and supplied. A predetermined gap is provided between the LCD 3 and the above-mentioned porous plate 2. The gap is adjustable to an arbitrary dimension.

[0042]

The surface of the LCD 3 is constructed such that a mono-sheet type instant photographic film "Cheki" (manufactured by Fuji Photo Film Co., Ltd.) as a photosensitive film can be loaded as packaged in a film pack 5, being spaced apart from the surface by a predetermined gap. The method to handle the "Cheki" film pack has been previously described in detail in Japanese Patent Application No. 2-319229 "Instant Camera" (see JP 4-194832 A) by the inventors of the present invention.

[0043]

That is, the "Cheki" film pack 5 constructed as shown in Fig. 2 is provided at one end thereof with a cutout 51 which admits a claw member (a claw) for extracting the film sheet from the film pack 5, and the film sheet which has undergone exposure is extracted from the film pack 5 by the above-mentioned claw member, and is transferred to a processing step by a conveying mechanism that is not shown. In Fig. 2, numeral 59 indicates the height of the edge (stepped portion) of the film pack 5. By setting the

height of this edge at a desired dimension, it is possible to set the distance between the display surface of the aforementioned transmission type image display device and the photosensitive surface of the photosensitive film at a arbitrary value.

[0044]

Here, the processing step means pushing open a processing liquid (developer) tube provided at one end of the film sheet beforehand and causing the developer to be uniformly spread over the entire inner surface of the film sheet. It is executed substantially simultaneously with the extraction of the film sheet from the film pack and the conveyance thereof. After the processing step, the film sheet is conveyed to the exterior of the apparatus through an extraction outlet (See Fig. 4).

[0045]

As is well known, an instant photographic film of this type makes it possible to form a complete image for appreciation in about several tens of seconds after the above-mentioned processing step. Thus, in the transfer apparatus, the function of performing up to the above-mentioned processing step is required. After one film sheet has been sent out, the next film sheet appears, realizing a preparation state for the next exposure

(transfer).

[0046]

Using a transfer apparatus constructed as mentioned above, comparative experiments with the varied dimensions as mentioned above were made and the results thereof will be described below.

[0047]

(Example)

As the porous plate 2, a porous plate was prepared in which circular through-holes 21 having a diameter of 5 mm were provided at a pitch of 0.1 mm (in terms of partition thickness; see Fig. 3) in a closest packed structure. The thickness of the porous plate 2 was 15 mm. The distance (spacer thickness) from the outlet side (upper surface) of the porous plate 2 to the LCD 3 was 2 mm. The above-mentioned "Cheki" film pack was used as the photosensitive film 4.

[0048]

In this construction, a transfer test was conducted while varying the dot dimension (shorter side) of the LCD 3 (two levels of 0.13 mm and 0.08 mm), varying the respective sum totals of the thicknesses of the substrates and the polarizing films on the incident side and the photosensitive film 4 side (three levels of 0.93 mm, 0.75

mm, and 0.57 mm), and varying the distance between the LCD 3 and the photosensitive film 4 (two levels of 1 mm and 2 mm).

[0049]

(Comparative Example)

As the porous plate 2, a porous plate was prepared in which circular through-holes 21 having a diameter of 5 mm were provided at a pitch of 0.1 mm in a closest packed structure. The thickness of the porous plate 2 was changed to 10 mm, and the distance from the outlet side (upper surface) of the porous plate 2 to the LCD 3 was changed to 5 mm.

In this construction, a transfer test was conducted, with the dot dimension (shorter side) of the LCD 3 being 0.13 mm, and the sum totals of the thicknesses of the substrates and the polarizing films on the incident side and the photosensitive film 4 side being 1.3 mm. The LCD 3 and the photosensitive film 4 were held in close contact with each other.

[0050]

In the above-mentioned transfer tests, the light-up time of the light source was adjusted such that transfer images of substantially the same density were obtained. For evaluation, the transfer images were observed by using

a microscope with a magnifying power of 10, evaluating the clarity of the RGB dots in five levels according to Table 1.

[0051]

(Table 1)

Table 1

Evaluation Point	Status
1	RGB dots are very clearly visible.
2	RGB dots are clearly visible.
3	RGB dots are visible without overlapping.
4	Not more than half the RGB dots are overlapping.
5	RGB dots are overlapping and indistinguishable.

[0052]

(Results)

The results of the Examples and Comparative Examples were summarized and shown in Table 2.

[0053]

(Table 2)

Table 2

Level	Thickness of substrate and polarizing film on photosensitive film side (mm)	Thickness of substrate and polarizing film on incident side (mm)	LCD dot shorter side length (mm)	Distance between LCD and photosensitive film (mm)	Diameter or equivalent diameter (mm)	Thickness (mm)	Thickness /diameter ratio	Evaluation
Example 1	0.93	0.93	0.13	1	5	15	3	3
Example 2	0.93	0.75	0.13	1	5	15	3	2.5 to 3
Example 3	0.75	0.75	0.13	1	5	15	3	2.5
Example 4	0.57	0.57	0.13	1	5	15	3	2
Example 5	0.93	0.93	0.08	1	5	15	3	2.5 to 3
Example 6	0.75	0.75	0.08	1	5	15	3	2.5
Example 7	0.57	0.57	0.08	1	5	15	3	2
Example 8	0.57	0.57	0.08	2	5	15	3	2.5
Comparative Example 1	1.3	1.3	0.13	0	5	10	2	5

[0054]

(Examination of the Results)

[0055]

As shown in Table 2, from the comparison of Examples with Comparative Example, it can be seen that when the sum totals of the thicknesses of the substrates and the polarizing films on the incident side and the photosensitive film 4 side are less than 1 mm, and the thickness of the porous plate is three times the diameter of the through-holes, the dot transfer condition is markedly improved (comparison of Examples with Comparative Example). In this case, the dot dimension (shorter side) of the LCD 3 does not influence so much.

[0056]

As stated above, the reduction in the sum totals of the thicknesses of the substrates and the polarizing films on the incident side and the photosensitive film 4 side is very effective in improving the image quality. Specifically, when the sum total thickness varies as: 0.93 mm, 0.75 mm, and 0.57 mm, the difference is clearly to be seen (comparison of Examples 1 to 4, Examples 5 to 8).

[0057]

The distance between the LCD 3 and the photosensitive film 4 does not influence the image quality so much as long

as it is within the range of approximately 2 mm (comparison of Examples 7 and 8). This is very advantageous in producing the apparatus since it facilitates the handling of the photosensitive film 4 (the aforementioned film sheet).

[0058]

Regarding the thickness of the porous plate 2, it can be seen that, from the relationship with the dimension of the through-holes provided in the porous plate 2, a markedly desirable effect is achieved when the value of the coefficient: "thickness of porous plate / through-hole dimension of porous plate" is not smaller than a certain value. That is, the above-mentioned value indicates the degree to which the light transmitted through the porous plate is approximated to parallel rays.

[0059]

Specifically, a reduction in the dimension of the through-holes or an increase in the thickness of the porous plate is effective. To achieve a reduction in the thickness of the entire apparatus, however, the former is more desirable. Due to the limitations in production, the lower limit of the through-hole dimension is approximately 0.2 mm. From the practical point of view, values of approximately 0.5 mm to 2 mm are preferable. Regarding the

thickness, values of approximately 3 mm to 20 mm are practical. While in the above example the value of the "thickness of porous plate / through-hole dimension of porous plate" is 3, this value is preferably not less than 5, and more preferably not less than 7.

[0060]

Another experiment showed that, due to the reduction in the LCD dot size, each dot was not so clearly transferred as compared with the case of the aforementioned "transfer apparatus" disclosed in JP 11-242298 A. In particular, when the LCD dot size is not more than 0.2 mm, the tendency is remarkable.

[0061]

From the above results, the effect obtained by the transfer apparatus of the present invention is obvious. That is, in the transfer apparatus of the present invention, the sum total of the thicknesses of the substrate and the polarizing film at least on the photosensitive film side of the LCD is set at not more than 1.0 mm, preferably not more than 0.8 mm, and more preferably not more than 0.6 mm, whereby it is possible to substantially improve the clarity of the transferred image.

[0062]

Fig. 4 is a diagram showing an example as a concrete,

commercialized product of the apparatus according to the construction shown in Fig. 1. In Fig. 4, numerals 1 to 4 indicate the same elements in the construction as shown in Fig. 1. Numeral 5 indicates the film pack, numeral 52 indicates the exposed-film extraction outlet of the film pack 5, numeral 6 indicates the main body case, numeral 61 indicates the roller for transferring an exposed-film and developing the processing liquid, numeral 62 indicates the outlet for extracting the exposed-film from the main body case 6, and numeral 63 indicates a back-up pressurizing pin of the exposed-film pack 5.

[0063]

The above-mentioned embodiment is an example of the present invention. It goes without saying that the present invention is not restricted to the embodiment. For example, ones with various functions within the permissible range may be adopted for the back light unit as the light source, the LCD for the image display device, or the like.

[0064]

[Effects of the Invention]

As described above in detail, in accordance with the present invention, it is possible to realize a transfer apparatus which enables, with a simple structure, actual reduction in size, weight, power consumption, and cost.

[0065]

The effect of the present invention can be further enhanced by adding the above-mentioned additional conditions to the above-described basic construction.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIG. 1] This is a conceptual side sectional view showing an image transfer apparatus according to an embodiment of the present invention.

[FIG. 2] This is a diagram illustrating the structure of the "Cheki" film pack used in the image transfer apparatus according to the embodiment.

[FIG. 3] This is a diagram illustrating the arrangement of through-holes in a porous plate according to the embodiment.

[FIG. 4] This is a diagram showing an example of the commercialized image transfer apparatus according to the embodiment.

[FIG. 5] This is a conceptual diagram showing an example of the prior art.

[Legend]

1 light source

2 porous plate

21 through-holes in the porous plate

3 LCD

4 photosensitive film (instant photographic film)

5 film pack

51 cutout

52 exposed-film extraction outlet

59 height of edge (stepped portion) of film pack 5

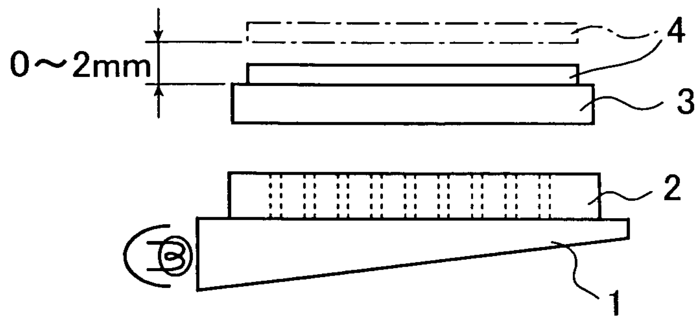
6 main body case

61 roller for transferring an exposed-film and developing processing liquid

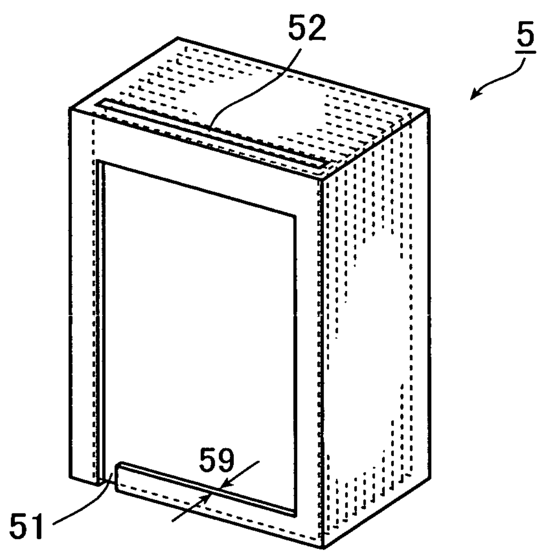
62 outlet for extracting the exposed-film

【TYPE OF THE DOCUMENT】Drawings

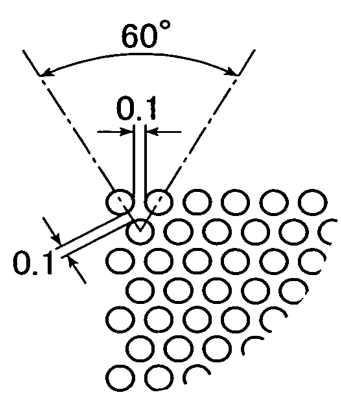
【FIG.1】



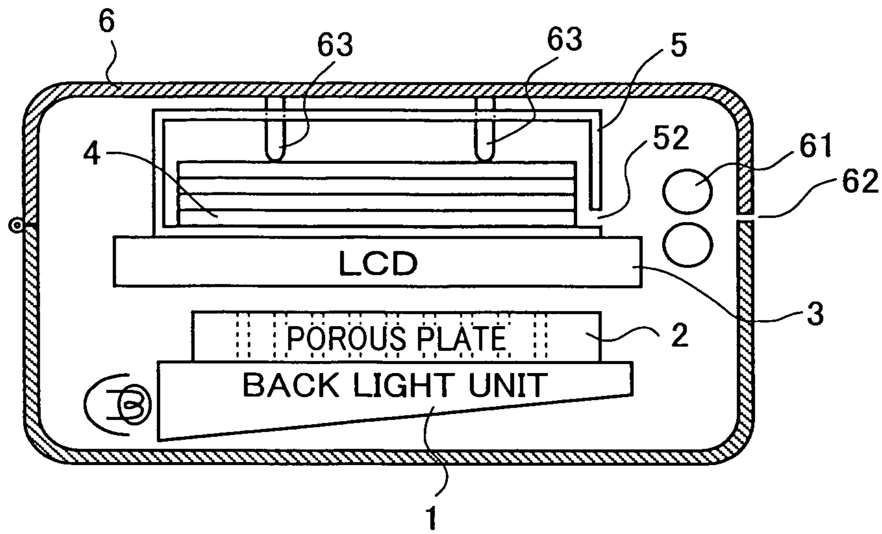
【FIG.2】



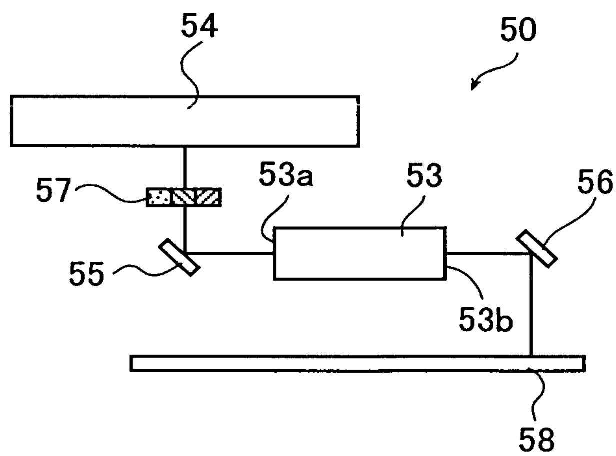
【FIG.3】



【FIG.4】


6
63
63
5
4
52
61
62
LCD
3
POROUS PLATE
2
BACK LIGHT UNIT
1

【FIG.5】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53a
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53b
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Japanese Patent Application No. 2000-308889

[TYPE OF THE DOCUMENT] Abstract

[ABSTRACT]

[Subject] It is to provide a transfer apparatus which enables, with a simple structure, actual reduction in size, weight, power consumption, and cost.

[Means for Solution] A transfer apparatus comprising a light source and a transmission type image display device (LCD) to transfer a displayed image on the transmission type LCD to a photosensitive film, wherein a sum total of thicknesses of a substrate and a polarizing film at least on a side of the photosensitive film in the transmission type LCD is 1.0 mm or less, preferably 0.8 mm or less, and more preferably 0.6 mm or less. It is preferable that the image displayed on the transmission type LCD and the image transferred to the photosensitive film are substantially identical in size.

[Selected Drawing] Fig. 1